Interstate Highway System Pavement Distress Survey Results

REGION 4

TECHNICAL SERVICES DIVISION
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
Mario M. Cuomo, Governor/Franklin E. White, Commissioner

INTERSTATE HIGHWAY SYSTEM

PAVEMENT DISTRESS SURVEY RESULTS

Region 4

July 1987

PAVEMENT MANAGEMENT SECTION
TECHNICAL SERVICES DIVISION
New York State Department of Transportation
State Campus, Albany, New York 12232

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I. INTRODUCTION

In 1983, the Department became interested in developing a pavement management system based on pavement distresses and engineering analyses of treatment needs. The Highway Management Committee -- comprised of the deputy commissioner and the assistant commissioners of administration and finance, engineering, operations, and public transportation -- provided the direction. The committee asked the Pavement Management Task Force to evaluate the Department's current survey methods and analytical procedures against state-of-the-art practices. Task force findings and recommendations are contained in their report, Highway Management Information Needs and Data Collection Requirements, dated December 1984. Based on these findings, the Highway Management Committee directed the Technical Services Division to develop a network-level pavement-distress survey, and to demonstrate its capabilities on the Interstate Highway System.

A network-level pavement-distress survey was developed and implemented in the fall of 1986 on more than 850 miles -- 1700 miles (both directions) -- of Interstate in Regions 1 through 10. Raw distress data produced by the survey were merged by the Data Services Bureau in the Planning Division with the Highway Sufficiency file to capture available inventory data. A methodology for interpreting survey data into treatment actions was developed along with microcomputer software incorporating this methodology.

The results of the 1986 Interstate Survey are reported herein. It includes a regional summary and detailed distress evaluations for individual highway sections. These sections are principally determined by original construction limits, and also by pavement type and county lines. Highway Section Reports provide information on dominant distresses, classes of work, and recommended or alternative treatments with estimated costs and expected lives. Resident engineers should find these uniform pavement evaluations helpful when submitting candidate projects in need of pavement or shoulder work. Regional summaries on the other hand are most useful for Department and regional managers in developing goals, making funding allocations, developing maintenance and capital programs, and monitoring performance.

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II. PAVEMENT EVALUATION METHOD

Pavement condition can be expressed in terms of distress, roughness, friction, and strength. The report, Highway Management information Needs and Data Collection Requirements, concludes that measurement of pavement distress is most useful for estimating work needed to correct pavement deficiencies. Pavement distress indicates that the limits of material properties have been exceeded under load (traffic, temperature, etc.). Distress characteristics also give clues to the mode of failure and possible causes. Deterioration rates are more precise, and consequently predictable if related to patterns of distress development. Relationships between deterioration rates and various engineering factors (traffic, pavement thickness, level of maintenance, materials quality, etc.) can then be determined. Finally, cost-effective pavement maintenance treatments can be developed and applied.

A. Pavement Distress Survey

The Pavement Distress Survey is subjective in evaluating pavement surface condition at the network level. A three-person crew continually evaluates the driving lane and outside shoulder from a slow moving van traveling the shoulder. Assessments are recorded every tenth mile. No physical measurements are taken.

Surface condition is assessed in terms of distress type, severity, and extent. Abbreviated distress scales are included in Appendix A. The scales are listed by distress type for each of the two pavement categories, rigid and overlay/flexible, and for shoulders. Distress attributes associated with severity are listed under the heading "severity." Extent descriptors are listed under the heading "extent." Rating codes corresponding to distress levels are in the column "level." For additional information on the Pavement Distress Survey refer to NSYDOT's Manual for Rating Pavement Distress on the Interstate System.

B. Definition of Highway Section

"Highway section" refers to a length of pavement and shoulder having uniform characteristics for evaluation purposes. The Pavement Distress Survey records distress assessments every tenth mile. However, most people are interested in highway sections having length that has significance -- for example, a length that may constitute a design, construction, or maintenance project.

Highway sections, therefore, are created by subdividing Interstate routes by state highway number. This approach is sound from an engineering point of view:

1. Original contract limits are preserved (same contractor),

2. Design and construction variables are normalized,

3. Traffic loadings are generally constant,

4. Maintenance of traffic considerations may dictate similar construction limits if repairs are necessary, and

5. Exposure to the environment (soils, temperature, etc.) is constant.

To address other significant considerations, highway sections must be further subdivided on pavement type and county. Pavement type is necessary to evaluate portions of rigid pavements which have been overlaid. County is included so survey results could be summarized on a regional basis.

In summary, highway sections serve as the basic unit for presenting survey data and performing pavement evaluations. They are determined by subdividing routes by state highway number, by pavement type, and by county.

C. Treatment Analysis

A methodology for interpreting distress data collected by the Pavement Distress Survey was developed last winter. The analysis is performed for a given highway section. From analysis of the data, the dominant distress governing treatment is identified. Also determined are the class of work, recommended treatment or alternatives, life expectancy, and estimated cost of treatment. This information is provided for pavements and also for shoulders (independent of pavements).

For a thorough discussion of the distress/treatment methodology, refer to the Technical Services Division preliminary report entitled A Systematic Method for Selecting a Pavement Repair Treatment Based on Distress Data, dated April 1987.

III. PAVEMENT EVALUATIONS

This chapter presents pavement evaluations based on distress data provided from the 1986 Interstate Survey. Reports are provided on two levels -- highway section and network. Information presented in the following section ("Highway Section Reports") is specific to a section of highway, and information in "Regional Summaries" is network level. Regional summaries are compilations of information contained in Highway Section Reports.

A. Highway Section Reports

Highway Section Reports have been prepared for both directional roadways of the Interstate System. Highway sufficiency and inventory data, however, exist only for the north or east directions. To reference the Pavement Distress Survey in opposite directions, the Data Services Bureau created an inventory file for the Technical Services Division that is a mirror image of the primary direction file. Inventory data collected by the Pavement Distress Survey was used to correct the newly created file for pavement type and reference marker locations. The number of lanes in each direction was subsequently determined to prepare accurate cost estimates for each roadway in Highway Section Reports. If ramps, weaving lanes, and climbing lanes occur over most of the highway section length, they are included in the number of directional lanes.

A complete Highway Section Report has three pages -- the first gives distress evaluations, the second summarizes distress ratings, and the third presents plots of each distress. Highway Section Reports are in Appendix C.

Some situations did not warrant preparation of a Highway Section Report. For sections or subsections less than 0.3 mile in length, only the first page with the inventory information is printed along with the message "Insufficient Data." If the section could not be rated (no shoulder, under construction, etc.), the message reads "No Data Available."

1. Distress Evaluations - First Page

The first page contains the report title, inventory information, pavement distress evaluations, and shoulder distress evaluations. Centered at the top of the sheet is information that identifies the highway section defined by original construction limits. Immediately below in two columns is inventory information about the section. If the original section has been subsectioned, inventory information pertains to the indicated subsection. "Year of Last Work" in Highway Sufficiency Ratings is not limited to pavements and also does not consider work by the Maintenance Division. "Type of Work" is not part of the highway sufficiency record. This part of the inventory should be reviewed and completed.

The pavement distress evaluation which follows is based on distress assessments obtained during the 1986 Interstate Survey.

Primary Distress identifies the dominant distress that determines treatment. Refer to Appendix A for descriptions of distress levels.

Class of Work categorizes treatment actions primarily by cost, and secondarily by nature of work -- Major, Intermediate, and Minor Rehabilitation; Preventive Maintenance; and Do Nothing categories.

Estimated Costs are for a highway section (length of directional roadway). Estimated costs are not lane-mile factored costs. The Materials Bureau provided estimated costs using average bid prices and quantity estimates for two-lane, three-lane, and four-lane roadways. In addition, separate sets of costs have been developed for upstate Regions (1 through 7 and 9), Region 8, and Region 10. Highway section costs are the product of the appropriate roadway-mile cost and section length. The cost estimate is only for pavement-related work. In some instances, ancillary work such as adjusting guiderail, signs, and drainage could double the project cost.

Recommended Treatment or Alternatives names the recommended treatment unless the distress analysis is inconclusive, in which case alternative treatments are named. Many treatments, like overlays, include shoulder work (a note to this effect is printed).

The last section on the page provides an evaluation of shoulders independent of pavement-treatment considerations. Format and explanations are similar to those used for pavements. Assumed in cost estimates are 4-and 10-ft shoulders (inside and outside, respectively).

2. Distress Rating Summaries -- Second Page

Two distress summary tables are presented on this page -- the first gives percent of section length affected, and the second accumulates percentages from right to left. The ratio of survey sections (tenth mile) having a particular distress level to the total surveyed in a highway section determines frequency of occurrence in percent. Both tables array percentages by distress type and level. Refer to Appendix A for distress level descriptions corresponding to rating codes.

The first table describes amounts of distress found in a highway section. Percent values agree with those in distress graphs on page 3 of the Highway Section Report. After one becomes familiar with the distress scales, information in the table can be used to describe pavement condition in terms of distress.

The second table gives cumulative percentages by distress level. These percentages are used for treatment analysis and selection. If pavement or shoulder evaluations in Highway Section Reports are questioned, this table

and a copy of A Systematic Method for Selecting Pavement Repair Treatment Based on Distress Data will allow one to determine the basis for treatment selection.

For rigid pavement sections there are two additional statements after the second table. "Effective % of Transverse Spalls" and "Effective % of Slab Cracks" are special values used to discriminate among certain treatments. Equations for calculating these percents and treatment action values can be found in the above referenced report.

3. Distress Graphs -- Third Page

Graphs for each distress are presented on page 3 of the Highway Section Report. Raw survey data collected at tenth mile intervals are plotted over the section length, so variations in distress level can readily be observed and interpreted.

The length of the x-axis is determined by original construction limits. If the plot is for a subsection, it is positioned relative to original construction limits. Thus, field location for any data point can be determined by simply counting tenth mile tic marks on the x-axis and referring to the "beginning reference marker number."

Percentages along the right side of each graph indicate the number of time a particular distress level was assessed in comparison to the total possible. Percentages are based on assessments made at tenth mile intervals and serve to summarize distress information for a highway section.

A graph sheet is not prepared when there is insufficient data or when data is not available.

B. Regional Summaries

Regional summaries present pavement evaluation information in a manner that will help guide management of pavement-related resources. Network level information is useful for describing the condition of the network, setting goals, developing maintenance programs, allocating funds, and monitoring progress towards stated goals.

Two tables (Table 1 for pavements and Table 2 for shoulders) give results of the 1986 Interstate Survey. Pavement information in Table 1 is listed by type, and by work class. Categories of information include: "route-miles" or length of interstate; route-miles expressed as a percent of total; "lane-miles" for both directional roadways; and "cost" of work. Information is also summarized for all pavement types.

Table 2 gives shoulder information by distress type and class of work. Categories of information include "shoulder-miles", shoulder-miles expressed a a percent of total, and "cost" of work. The term shoulder-miles refers to the

Table 1

INTERSTATE SURVEY SUMMARY

Region 4

Pavement Distress Evaluation					
Pavt. Type	Work Class	Route Miles	Route Miles %	Lane Miles	Cost
Rigid	Major Rehab.	37.3	47.8	172.9	$18,436,000
	Interm.Rehab.	4.0	5.1	17.7	$1,245,000
	Minor Rehab.	0.0	0.0	0.0	$0
	Prev.Maint.	28.2	36.1	114.5	$1,541,000
	Do Nothing	4.3	5.5	17.2	$0
	Not Evaluated	4.3	5.5	26.9	$0
Total		78.1	100.0	349.2	$21,222,000
Overlay	Major Rehab.	0.0	0.0	0.0	$0
	Interm.Rehab.	0.0	0.0	0.0	$0
	Minor Rehab.	0.0	0.0	0.0	$0
	Prev.Maint.	0.4	10.8	2.4	$6,000
	Do Nothing	0.0	0.0	0.0	$0
	Not Evaluated	3.3	89.2	14.6	$0
Total		3.7	100.0	17.0	$6,000
Flexible	Major Rehab.	0.0	0.0	0.0	$0
	Interm.Rehab.	6.3	40.4	30.0	$2,068,000
	Minor Rehab.	3.2	20.5	13.0	$737,000
	Prev.Maint.	0.0	0.0	0.0	$0
	Do Nothing	4.2	26.9	25.2	$0
	Not Evaluated	1.9	12.2	11.1	$0
Total		15.6	100.0	79.3	$2,805,000
All	Major Rehab.	37.3	38.3	172.9	$18,436,000
	Interm.Rehab.	10.3	10.6	47.7	$3,313,000
	Minor Rehab.	3.2	3.3	13.0	$737,000
	Prev.Maint.	28.6	29.4	116.9	$1,547,000
	Do Nothing	8.5	8.7	42.4	$0
	Not Evaluated	9.5	9.8	52.6	$0
Grand Total		97.4	100.0	445.5	$24,033,000

Table 2

INTERSTATE SURVEY SUMMARY

Region 4

Shoulder Distress Evaluation

Distress Type	Shldr. Miles 2-way	Shldr. Miles %	Work Class	Shldr. Miles 2-way	Shldr. Miles %	Cost
Distorted	0.0	0.0	Major Rehab.	0.0	0.0	$0
Disintegrated	68.9	35.3	Minor Rehab.	68.9	35.3	$1,206,000
Cracked	78.7	40.4	Prev.Maint.	78.7	40.4	$402,000
Dropoff>2"	0.0	0.0	Do Nothing	28.5	14.6	$0
Insignificant	28.5	14.6	Not Evaluated	18.9	9.7	$0
Not Evaluated	18.9	9.7				
			Total	195.0	100.0	$1,608,000
Total	195.0	100.0				

length of roadway having shoulders (assume 4-ft inside and 10-ft outside shoulder). Since interstate routes have two roadways, shoulder-miles are the total length in both directions.

Information presented in Tables 1 and 2 is based on pavement distress data collected and interpreted in a uniform manner. Costs represent only pavement-related costs and not ancillary work that may also be required (refer to III.A.1., Distress Evaluations - First Page, for a description on how costs are calculated).

Not all work indicated need be done in a single construction season. A highway section will remain at an indicated work class for a period of time. Some sections may be just entering a particular class of work, another group may already have been there for several years, and other highway sections may be about to move into the next, more costly, work class. Work on the latter group can no longer be deferred without incurring additional costs, and should therefore be given priority over other highway sections if they can be identified. Appendix B includes candidate projects by class of work to assist in selecting projects for annual programs.

Shoulder condition reported by the Pavement Distress Survey may be underestimated. The survey rates only shoulder 8 ft or wider, treating lesser widths as insufficient to rate. In the past, the Maintenance Division has not always maintained full design width of shoulders. Rating conventions employed in the Interstate Survey do not deduct for shoulders maintained below design standards.

Shoulder work needs and costs are estimated independent of work that may be required on pavements.

IV. USE OF HIGHWAY SECTION REPORTS AND REGIONAL SUMMARIES

This chapter discusses the proper uses of the Interstate Survey information presented in this report. Uses recommended here include survey methodology, data analysis procedures, validity of assumptions, and precision of variables.

A. Survey Information

Highway Section Reports and regional summaries provide technical information not now available in the Department's pavement management process. The information is intended to influence complex decisions regarding the management of pavement resources -- not to dictate solutions. Proper application of the Interstate Survey findings should lead to a more systematic, cost-effective approach to pavement management.

The Pavement Distress Survey and treatment methodology provide the following advantages:

-- Engineering data on the condition of pavements and shoulders at the network level.

-- Uniform documentation of pavement distress across regional boundaries.

-- Uniform statewide interpretation of distress data using a computer software treatment-selection matrix.

-- Most current maintenance and rehabilitation treatments incorporated in the analytical software.

-- Use of current, weighted average bid prices, which are geographically sensitive.

-- Uniform maintenance treatments statewide for a given pavement or shoulder condition.

-- Distress assessments on both directional roadways of a divided highway.

This information also has however the following shortcomings:

-- Inherent inaccuracies common to subjective surveys.

-- Use of only six pavement distresses to evaluate pavement work needs.

-- Documentation of distresses in driving lane and outside shoulder only.

-- No consideration for other pavement characteristics -- roughness, friction, and structural capacity.

-- One-time survey -- no prediction and deterioration rates unless repeated.

-- No assessment of drainage.

-- Limitations of Sufficiency File data base -- no truck axle loadings, maintenance histories, or pavement performance factors.

-- Scope limited to pavement and shoulder work needs, with no consideration of other highway needs.

-- Scope limited to the identification of work that can be budgeted and scheduled, as opposed to "demand-maintenance" work.

ACKNOWLEDGMENTS

This project is the responsibility of the Pavement Management Section of the Technical Services Division and is being conducted under the general supervision of Gerald Perregaux, Pavement Management Engineer. The 2-1/2 year long project includes development of a pavement distress survey, implementation of the survey on the Interstate Highway System, and analysis of the survey data. Many persons have been involved with this project at one time or another providing valuable assistance. Those that warrant special acknowledgment for their contribution of time, knowledge, or expertise are listed here in chronological order.

Lyndon Moore, former Director of Technical Services Division, introduced the Department to the concepts and principles of pavement management. As a proponent of pavement distress surveys, he was instrumental in making this project a reality.

Geoff Wood of the Engineering Research and Development Bureau prepared a comprehensive document entitled Pavement Distress Survey Manual which describes distresses and methods of measurement in detail.

Fred Hiss, Assistant Director of the Engineering Research and Development Bureau, obtained resident engineer information on pavement distresses and produced a detailed distress survey requiring physical measurements.

Professor Dimitri Grivas, a consultant, introduced the concepts of linguistic distress survey scales, "fuzzy set" mathematical analyses, and expert systems. He provided invaluable guidance and structure to development of the survey during its early stages.

Jack Vyce of the Engineering Research and Development Bureau provided considerable assistance in developing distress scales for the survey by sharing his extensive knowledge of distresses and their measurement. Peter Bellair, also of Engineering Research, provided consultation and staff support.

William Cuerdon of the Pavement Management Section oversaw field activities involved in development of distress scales and was responsible for much of the analysis and documentation. Also joining the team on temporary assignment were Dave Richards of the Materials Bureau and Dave Ingalls and Ross Alexander of the Soil Mechanics Bureau. This group conducted training sessions for the survey teams and provided the standard against which assessments by other teams were judged. Amy Hyland of the Pavement Management Section also assisted in development of distress scales.

The following personnel conducted pavement surveys during the pilot phases of the project: Ed Bikowitz, Mark Flynn, Bob Longint, Jeff McCullough, Jim Noonan, and Dick Wright of the Engineering Research and Development Bureau; Dave Richards of the Materials Bureau; and Kevin Eager and Paul Kucerak of the Soil Mechanics Bureau.

Bill Bord, Region 1's Safety Representative, prepared the section on safety in the Pavement Distress Survey Manual and presented a session on safety at the training session for survey crews.

John Shufon of the Data Services Bureau was largely responsible for conducting the Interstate Survey. He and his staff recruited survey personnel, arranged for survey vehicles and support, designed and printed the survey form, provided data collection and editing services, and merged the distress survey data with the Highway Sufficiency file. John is to be commended for his diligent efforts under severe time and resource constraints. Fred Neveu prepared the mainframe computer program for merging distress survey data with the highway sufficiency data into a combined file.

The Highway Maintenance and Equipment Management Divisions provided support services for the Interstate Survey. Special recognition goes to Ray Oliver who arranged for survey vehicles and to Frank Trendell for arranging safety backup vehicles.

Survey teams for the Interstate Survey were comprised of personnel drawn from many sections of the Department. Participating in the survey were: Jack Albertine, John Divirgilio, and Tom O'Hare from Region 1 Planning; Tim Lusher, Region 2 Planning; Mat Patla, Region 3 Construction; Gerald Spencer, Region 4 Construction; Richard Owarczak, Region 5 Design; Steve Hall, Region 6 Design; Jim Bevens, Region 7 Construction; Mark Sagar, Region 8 Planning; Tom Beirut, Region 9 Design; Wadith Isdith, Region 10 Design; Tom Baldowski, Gloria Jillson, Brian Kirch from Main Office Data Services Bureau -- a total of 15 surveyors.

The Engineering Research and Development Bureau provided all support required for computer programming. Mike Fitzpatrick developed programs in BASIC for reporting distress survey data. He also provided dBASE programs that created and manipulated survey data. Gerry Anania provided all the BASIC programming required in the latter stages of the project. He downloaded mainframe files to microcomputers, automated the reporting process, and provided numerous enhancements to the analytical program, including regional cost factors and highway subsection plotting capability.

Wayne Brule, Assistant Director of the Materials Bureau, chaired a task force which produced the methodology for interpreting distress information into treatment actions. This critical step permitted survey data to be reported in a meaningful format to users.

APPENDIX A

Pavement Distress Survey Scales

RIGID PAVEMENT DISTRESS SCALES

TRANSVERSE JOINT FAULTING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
OBVIOUS (>1/2")	1-2 JOINTS	LI
	>2 JOINTS	LG

TRANSVERSE JOINT SEAL		
SEVERITY	EXTENT	LEVEL
NONE	—	N
ANY OR ALL OF SEAL(S) MISSING	1-2 JOINTS	LI
	>2 JOINTS	LG

TRANSVERSE JOINT SPALLING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
<3" WIDE, ANY PORTION OF JOINT	1-2 JOINTS	SI
	>2 JOINTS	SG
>3" WIDE, <1/2 JOINT LENGTH	1-2 JOINTS	MI
	>2 JOINTS	MG
>3" WIDE, >1/2 JOINT LENGTH	1-2 JOINTS	LI
	>2 JOINTS	LG
FULL-WIDTH CUT, REMOVED AND PATCHED	1-2 JOINTS	TI
	>2 JOINTS	TG

SLAB CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	1-2 SLABS	SI
	>2 SLABS	SG
OPEN	1-2 SLABS	MI
	>2 SLABS	MG
WIDE, SPALLED, AND/OR FAULTED	1-2 SLABS	LI
	>2 SLABS	LG
BROKEN SLAB	1-2 SLABS	TI
	>2 SLABS	TG

LONGITUDINAL JOINT SPALLING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
<6" WIDE	1-2 SLABS	SI
	>2 SLABS	SG
6"-10" WIDE	1-2 SLABS	MI
	>2 SLABS	MG
>10" WIDE	1-2 SLABS	LI
	>2 SLABS	LG

SURFACE DETERIORATION		
SEVERITY	EXTENT	LEVEL
NONE	—	N
PITTING	1-2 SLABS	SI
	>2 SLABS	SG
FEW (<3) SPALLS	1-2 SLABS	MI
	>2 SLABS	MG
NUMEROUS (>3) SPALLS	1-2 SLABS	LI
	>2 SLABS	LG

FLEXIBLE/OVERLAY PAVEMENT DISTRESS SCALES

CENTERLINE CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

LONGITUDINAL CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

EDGE CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

TRANSVERSE CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

RAVELING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
BINDER LOSS	OCCASIONAL	SI
	FREQUENT	SG
AGGREGATE LOSS	OCCASIONAL	MI
	FREQUENT	MG
AGGREGATE LOSS TO POTHOLED CONDITION	OCCASIONAL	LI
	FREQUENT	LG

RUTTING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
OBVIOUS >1"	OCCASIONAL	SI
	FREQUENT	SG

SHOULDER DISTRESS SCALES

SHOULDER CONDITION		
SEVERITY	EXTENT	LEVEL
NONE	—	N
CRACKING	OCCASIONAL	SI
	FREQUENT	SG
SURFACE MATERIAL LOSS	OCCASIONAL	MI
	FREQUENT	MG
DISTORTION	OCCASIONAL	LI
	FREQUENT	LG

LANE/SHOULDER DROPOFF		
SEVERITY	EXTENT	LEVEL
NONE	—	N
<1"	OCCASIONAL	SI
	FREQUENT	SG
1"-2"	OCCASIONAL	MI
	FREQUENT	MG
>2"	OCCASIONAL	LI
	FREQUENT	LG

APPENDIX B

Candidate Projects by Work Class

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> DO NOTHING

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVEMENT	LANE MILES	COST
390	79-17	1	390I-4202-1170	RIGID	17.2	0
390	77-29	1	390I-4303-1080	FLEXIBLE	3.0	0
390	77-29	1	390I-4303-1080	FLEXIBLE	2.7	0
390	77-23	1	390I-4303-1109	FLEXIBLE	2.1	0
390	77-23	1	390I-4303-1109	FLEXIBLE	3.6	0
390	77-23	2	390I-4303-1139	FLEXIBLE	4.8	0
390	77-23	2	390I-4303-1139	FLEXIBLE	2.1	0
390	77-29	2	390I-4303-1109	FLEXIBLE	2.7	0
390	77-29	2	390I-4303-1109	FLEXIBLE	4.2	0
SUBTOTAL BY ROUTE					42.4	0

****

TOTAL ON WORK CLASS--> DO NOTHING

TOTAL LANE MILES = 42.4
TOTAL COST = $0

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> PREVENTIVE MAINTENANCE

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVEMENT	LANE MILES	COST
390	77-10	1	390I-4202-1057	RIGID	11.0	147000
390	78-08	1	390I-4202-1263	RIGID	13.0	174000
390	77-33	1	390I-4202-1328	RIGID	15.4	207000
390	76-3	1	390I-4303-1046	RIGID	6.8	91000
390	76-3	2	390I-4303-1080	RIGID	6.6	88000
390	77-33	2	390I-4303-1046	RIGID	15.4	207000
390	78-08	2	390I-4202-1328	RIGID	13.0	174000
390	79-17	2	390I-4202-1263	RIGID	17.2	231000
390	77-10	2	390I-4202-1112	RIGID	11.0	147000
SUBTOTAL BY ROUTE					109.4	1466000
490	68-7	2	490I-4302-2026	RIGID	5.1	75000
SUBTOTAL BY ROUTE					5.1	75000
590	65-12	1	590I-4301-1017	OVERLAY	1.2	3000
590	65-12	2	590I-4301-1032	OVERLAY	1.2	3000
SUBTOTAL BY ROUTE					2.4	6000

****

TOTAL ON WORK CLASS--> PREVENTIVE MAINTENANCE

TOTAL LANE MILES = 116.9
TOTAL COST = $1547000

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> MINOR REHABILITATION

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVEMENT	LANE MILES	COST
390	79-05	1	390I-4202-1112	FLEXIBLE	11.6	658000
390	79-17	2	390I-4202-1263	FLEXIBLE	1.4	79000
SUBTOTAL BY ROUTE					13.0	737000

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TOTAL ON WORK CLASS--> MINOR REHABILITATION

TOTAL LANE MILES = 13.0
TOTAL COST = $737000

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> INTERMEDIATE REHABILITATION

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVEMENT	LANE MILES	COST
390	77-12	1	390I-4202-1025	RIGID	6.2	454000
390	79-17	1	390I-4202-1170	FLEXIBLE	1.4	102000
390	78-7	1	390I-4303-1139	FLEXIBLE	4.5	289000
390	78-7	2	390I-4303-2000	FLEXIBLE	4.5	289000
390	79-05	2	390I-4202-1170	FLEXIBLE	11.6	847000
390	77-12	2	390I-4202-1057	RIGID	6.4	468000
SUBTOTAL BY ROUTE					34.6	2449000
490	68-7	1	490I-4302-2007	RIGID	5.1	323000
SUBTOTAL BY ROUTE					5.1	323000
590	78-7	1	590I-4301-1000	FLEXIBLE	3.2	233000
590	78-7	2	590I-4301-1017	FLEXIBLE	4.8	308000
SUBTOTAL BY ROUTE					8.0	541000

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TOTAL ON WORK CLASS--> INTERMEDIATE REHABILITATION

TOTAL LANE MILES = 47.7
TOTAL COST = $3313000

1986 INTERSTATE SURVEY
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CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> MAJOR REHABILITATION

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVEMENT	LANE MILES	COST
390	66-1	1	390I-4202-1000	RIGID	5.0	644000
390	62-14	1	390I-4303-4000	RIGID	6.3	708000
390	60-26	1	390I-4303-7016	RIGID	1.2	112000
390	62-14	2	390I-4303-7016	RIGID	6.3	588000
390	66-1	2	390I-4202-1025	RIGID	4.8	618000
SUBTOTAL BY ROUTE					23.6	2670000
490	63-14	1	490I-4101-2128	RIGID	11.8	1266000
490	62-11	1	490I-4302-1044	RIGID	12.4	1330000
490	61-14	1	490I-4302-1106	RIGID	5.4	695000
490	61-15	1	490I-4302-1133	RIGID	2.8	360000
490	61-6	1	490I-4302-1147	RIGID	7.5	701000
490	60-13	1	490I-4302-1172	RIGID	3.6	311000
490	61-19	1	490I-4302-2000	RIGID	2.8	242000
490	58-2	1	490I-4302-2038	RIGID	6.9	775000
490	58-16	1	490I-4302-3000	RIGID	4.4	458000
490	56-9	1	490I-4302-3011	RIGID	4.6	493000
490	54-1	1	490I-4302-3034	RIGID	8.8	944000
490	67-10	1	490I-4302-3078	RIGID	9.9	925000
490	61-19	2	490I-4302-2007	RIGID	2.1	196000
490	60-13	2	490I-4302-2000	RIGID	3.0	280000
490	61-6	2	490I-4302-1172	RIGID	7.5	701000
490	61-15	2	490I-4302-1147	RIGID	4.2	392000
490	61-14	2	490I-4302-1133	RIGID	5.4	695000
490	62-11	2	490I-4302-1106	RIGID	12.4	1330000
490	63-14	2	490I-4302-1044	RIGID	11.6	1244000
490	67-10	2	490I-4403-1018	RIGID	6.6	708000
490	54-1	2	490I-4302-3078	RIGID	8.8	944000
490	56-9	2	490I-4302-3034	RIGID	4.6	493000
490	58-16	2	490I-4302-3011	RIGID	2.2	283000
SUBTOTAL BY ROUTE					149.3	15766000

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> MAJOR REHABILITATION

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVMENT	LANE MILES	COST

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TOTAL ON WORK CLASS--> MAJOR REHABILITATION

TOTAL LANE MILES = 172.9
TOTAL COST = $18436000

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> NOT EVALUATED

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVEMENT	LANE MILES	COST
390	77-29	1	390I-4303-1080	RIGID	0.9	0
390	77-29	1	390I-4303-1080	FLEXIBLE	0.3	0
390	77-29	1	390I-4303-1080	RIGID	0.3	0
390	77-23	1	390I-4303-1109	RIGID	0.4	0
390	77-23	1	390I-4303-1109	RIGID	0.4	0
390	77-23	1	390I-4303-1109	FLEXIBLE	0.8	0
390	77-23	1	390I-4303-1109	RIGID	0.4	0
390	77-23	1	390I-4303-1109	FLEXIBLE	0.4	0
390	77-23	1	390I-4303-1109	RIGID	1.2	0
390	77-39	1	390I-4303-2000	FLEXIBLE	0.9	0
390	77-39	1	390I-4303-2000	OVERLAY	1.0	0
390	77-39	1	390I-4303-2000	FLEXIBLE	0.3	0
390	60-26	2	390I-4303-7020	OVERLAY	1.2	0
390	77-39	2	390I-4303-4000	FLEXIBLE	1.2	0
390	77-39	2	390I-4303-4000	RIGID	1.2	0
390	77-39	2	390I-4303-4000	FLEXIBLE	0.6	0
390	77-23	2	390I-4303-1139	RIGID	1.2	0
390	77-23	2	390I-4303-1139	FLEXIBLE	0.4	0
390	77-23	2	390I-4303-1139	RIGID	0.4	0
390	77-23	2	390I-4303-1139	FLEXIBLE	0.4	0
390	77-23	2	390I-4303-1139	RIGID	0.4	0
390	77-23	2	390I-4303-1139	RIGID	0.4	0
390	77-29	2	390I-4303-1109	RIGID	0.3	0
390	77-29	2	390I-4303-1109	FLEXIBLE	0.3	0
390	77-29	2	390I-4303-1109	RIGID	0.9	0
SUBTOTAL BY ROUTE					16.2	0
490	68-7	1	490I-4302-2007	OVERLAY	0.4	0
490	71-7	1	490I-4302-2026	FLEXIBLE	2.1	0
490	71-7	1	490I-4302-2026	RIGID	2.0	0
490	58-2	1	490I-4302-2038	OVERLAY	0.6	0
490	60-6	1	490I-4302-2063	RIGID	2.1	0
490	60-6	2	490I-4302-3000	RIGID	3.2	0
490	58-2	2	490I-4302-2063	RIGID	6.9	0

1986 INTERSTATE SURVEY
REGION 4

CANDIDATE PROJECT BY WORK CLASS
BASED ON PAVEMENT DISTRESS EVALUATION

WORK CLASS--> NOT EVALUATED

ROUTE	SHNO	DIR	BEGINNING REF. MARKER	TYPE PAVMENT	LANE MILES	COST
490	58-2	2	490I-4302-2063	OVERLAY	0.6	0
490	71-7	2	490I-4302-2038	RIGID	1.5	0
490	71-7	2	490I-4302-2038	FLEXIBLE	2.8	0
490	68-7	2	490I-4302-2026	OVERLAY	0.6	0
SUBTOTAL BY ROUTE					22.8	0
590	78-7	1	590I-4301-1000	RIGID	0.3	0
590	65-12	1	590I-4301-1017	OVERLAY	2.2	0
590	63-4	1	590I-4301-1032	OVERLAY	3.0	0
590	63-8	1	590I-4301-2000	FLEXIBLE	0.2	0
590	60-9	1	590I-4301-2001	OVERLAY	0.8	0
590	60-9	2	590I-4301-2005	OVERLAY	1.2	0
590	63-8	2	590I-4301-2002	FLEXIBLE	0.4	0
590	63-4	2	590I-4301-2000	OVERLAY	3.0	0
590	65-12	2	590I-4301-1032	RIGID	2.2	0
590	78-7	2	590I-4301-1017	RIGID	0.3	0
SUBTOTAL BY ROUTE					13.6	0

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TOTAL ON WORK CLASS--> NOT EVALUATED

TOTAL LANE MILES = 52.6
TOTAL COST = $0

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GRAND TOTALS

LANE MILES = 445.5
TOTAL COST = $24033000

APPENDIX C

Highway Section Reports (bound separately)

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